Industry/University Center for Biosurfaces (IUCB)

State University of New York at Buffalo, The University of Memphis, New York State College of Ceramics at Alfred University

A National Science Foundation Industry/ University Cooperative Research Center since 1988

Understanding, predicting, and controlling biological adhesion can advance the development of safe/effective new materials

Center Mission and Rationale

The Industry/University Center for Biosurfaces (IUCB) has this vision —

- To come to understand the interactions of all that which is alive with all that which is not
- Through such understanding, to predict how living cells will attach to other materials, and to other cells
- Ultimately, to control the speed and strength of biological surface interactions for the benefit of personal, public, and environmental health.

The Center's immediate goals are —

- To produce standardized experimental models of cell/surface accumulation (biofilms)
- To identify possible and preferred "planes of intervention" into these films by cleaning and infection-control agents
- To produce relevant experimental models for adhesion to skin, tissue, and bone
- To identify improvements in wound healing associated with control of bioadhesion to synthetic/ prosthetic materials
- To produce relevant environmental simulations of flowing biofluids (blood, tears, saliva, others) at and near contact surfaces
- To identify fundamental force, structure, and flow features capable of modulating cell attachment/ retention at critical interfaces.

Research Program

The Center for Biosurfaces conducts basic research to control deposits on surfaces in medical, dental, and natural environments without using biocides. The broad application potential of this research includes the fields of biomaterials, bioengineering and biotechnology, occupational safety, and health. Pollution is avoided and air quality is protected, as potentially toxic or infectious aerosols are detected, collected, and analyzed. Practical applications of the Center's research are nontoxic coatings and safer medical products. IUCB employs a comprehensive and integrated approach to biological systems in diverse circumstances, from surgical suites to the open ocean.

The Center's faculty developed safe and effective fouling-release coatings by extrapolating bioengineering technology from pioneering work with biomaterials for artificial hearts. The Center discovered that a very narrow and specific range of critical surface tensions must be produced if biological debris is to be prevented from accumulating on the surfaces of biomedical and commercial devices. Surprisingly, nonstick Teflon

Center investigators have studied the biosurface properties of living dolphins.

The Automated Langmuir Adam Trough is used to produce monolayer and multilayer films of organic polymeric molecules.

materials are not included in this range, and many previous attempts to control biofouling failed because that fact was not known.

Researchers at IUCB also demonstrated that affordable commercial materials with biofouling-releasing qualities can be created. The family of crosslinked methylsilicones is the best engineering choice for use in the open environment. Moreover, laminated polymer alloys can be made between tough, elastic-base coatings of hardy polyurethanes and methylsilicone topcoats, thereby overcoming many application problems. Currently, no leachable components of any sort are included in these new compositions. Future research may lead to impregnating these new materials with nontoxic fouling-inhibitor agents isolated from seagrasses, sponges, or corals.

The engineering utility of the first-generation coatings has already been developed by international manufacturers and confirmed in investigations independently funded by the Electric Power Research Institute and the U.S. Navy.

One current IUCB project is to introduce nontoxic, nonpolluting coatings to control zebra mussel infestations in and around the Great Lakes. The Center's approach eliminates the need to add more chlorine, hot water, or other environmental insults to precious freshwater systems.

Special Center Activities

The Center's industrial sponsors receive priority attention for research. The Center has recently completed industrial projects in areas including —

- Surface characterization of metals, ceramics, and plastics
- Surface modification of polymers
- Evaluation of implant biocompatibility
- Formation of mineral scale in industrial processes
- Development of fiber-optic sensors
- Certification of new sterilization processes
- Definition of materials resistant to biocorrosion
- Control of biofouling.

The Center's cooperating laboratories contain state-of-the-art equipment. A field emission scanning electron microscope, scanning Auger microprobe, and electron spectrometer for chemical analysis are among many instruments applied in Center projects.

Center Headquarters

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